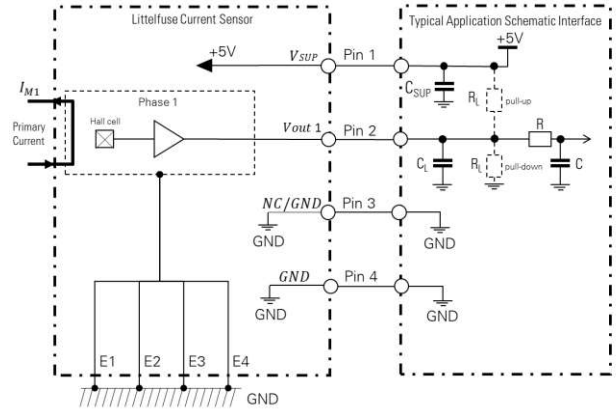
Current Sensor
CH1P01xM

Description

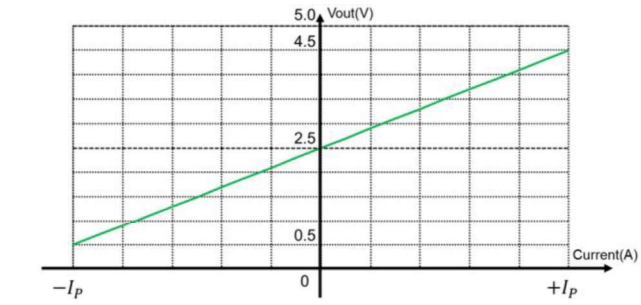
Littelfuse CH1P01xM current sensor is an open-loop Hall Effect device which provides a ratiometric output signal proportional to the magnetic flux density generated by a C-core concentrator. The sensor is offered in three configurations: full isolation sleeve, partial isolation sleeve and without isolation sleeve.

Typical Application Diagram



For optimal ESD performance it is recommended to connect PIN 3 to GND.

Output Characteristics



Features

- Open-loop Hall effect
- Current measurement: up to ±900A
- +5V DC unipolar power supply
- Operating temp. range: -40°C ... +125°C
- Busbar isolated measurement
- ASIL-QM

Applications

- Motor Inverter
- Starter Generators
- DC/DC Converter
- AC/DC Converter

Benefits

- High sensing accuracy
- Low thermal offset drift
- Low thermal sensitivity drift
- Non-intrusive solution
- Compact design for PCB mounting

Mechanical Characteristics

- Housing Material: PPA-GF33 UL94-V0
- Sensor pins: Sn plating
- Mass pins: Sn plating
- Mass: 34g

Soldering Methods

- Manual / Robot Iron Soldering
- Selective Soldering
- Wave Soldering

Littelfuse
Expertise Applied | Answers Delivered

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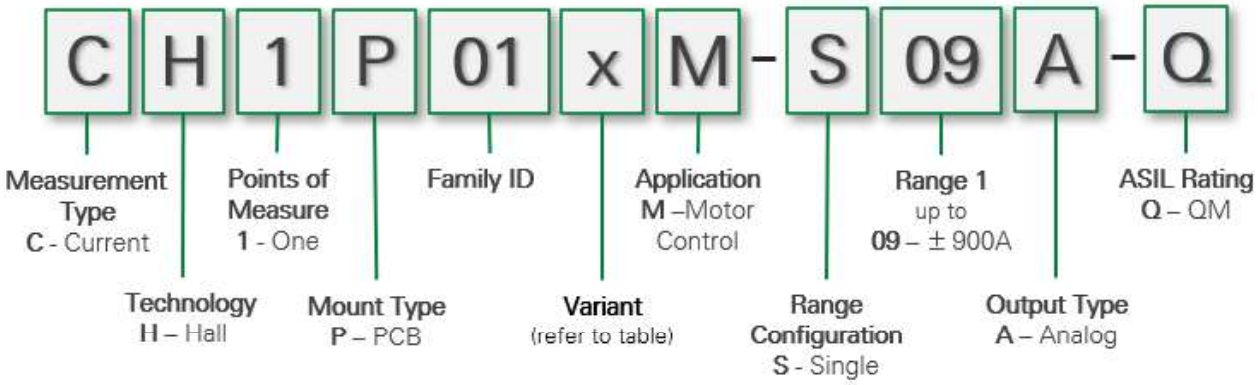
Littelfuse Current Sensor Naming Convention



Product Name by configuration

Part Name	Config	Ref. Image
CH1P012M	No Sleeve	
CH1P013M	Partial Sleeve	
CH1P014M	Full Sleeve	

Current Range Definition

Littelfuse offers customized calibration ranges.

Naming Examples:

Type Name	Current Range Out
CH1P01xM-**S04A-Q**	**±400 A**
CH1P01xM-**S05A-Q**	**±500 A**
CH1P01xM-**S06A-Q**	**±600 A**
CH1P01xM-**S07A-Q**	**±700 A**
CH1P01xM-**S08A-Q**	**±800 A**
CH1P01xM-**S09A-Q**	**±900 A**

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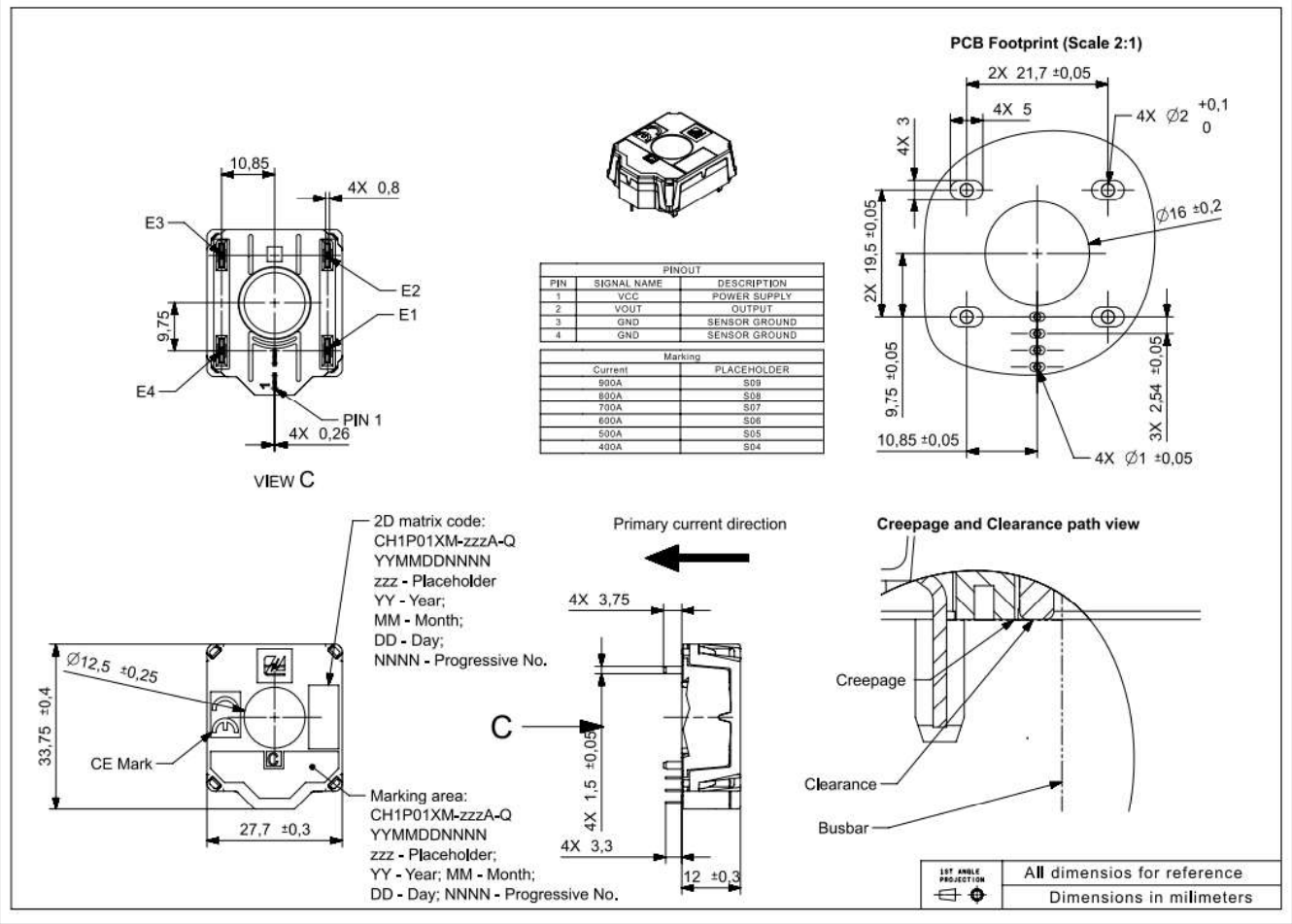
Current Sensor Dimensions (in mm)

CH1P012M – No Sleeve



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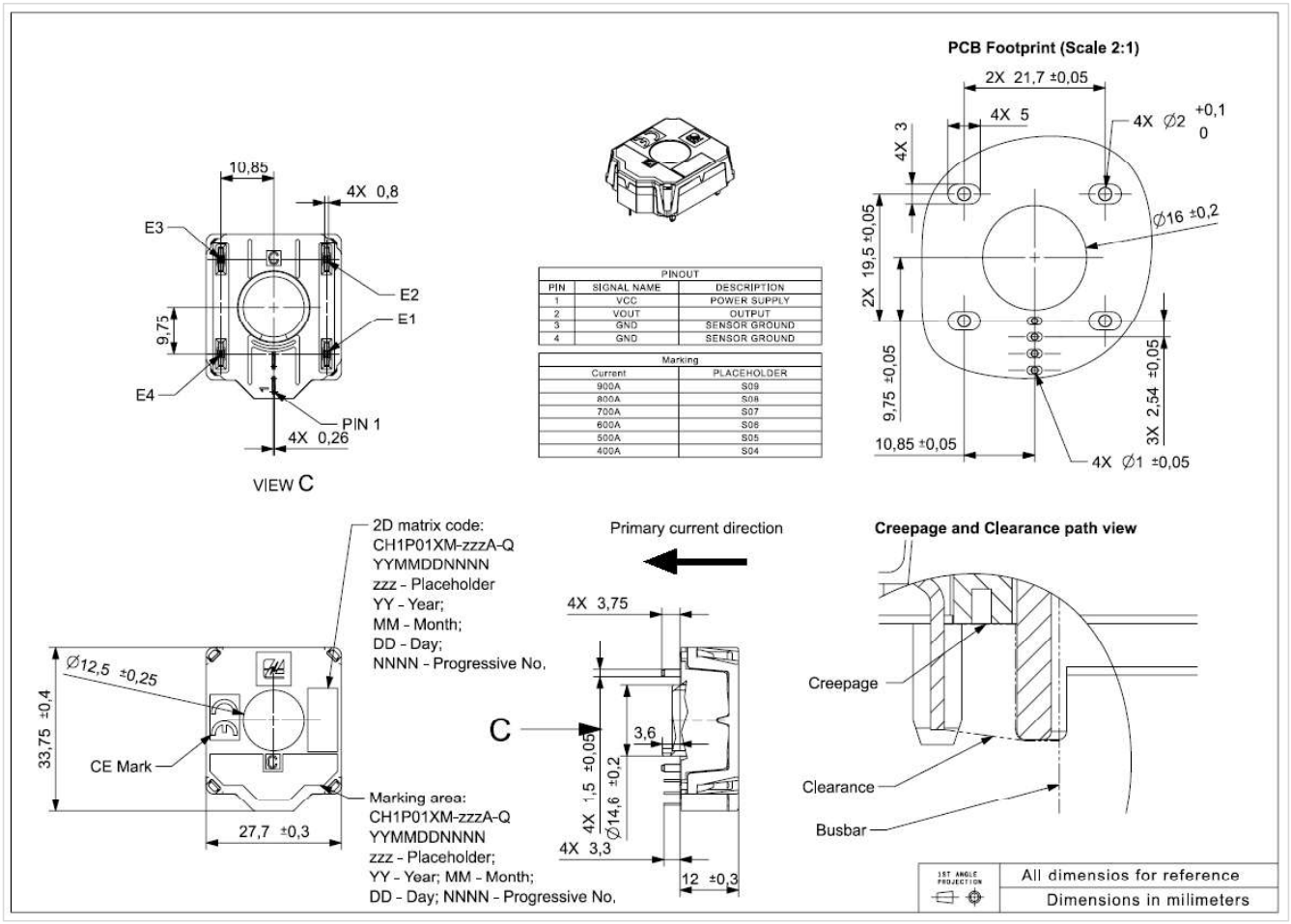
Current Sensor Dimensions (in mm)

CH1P013M – Partial Sleeve



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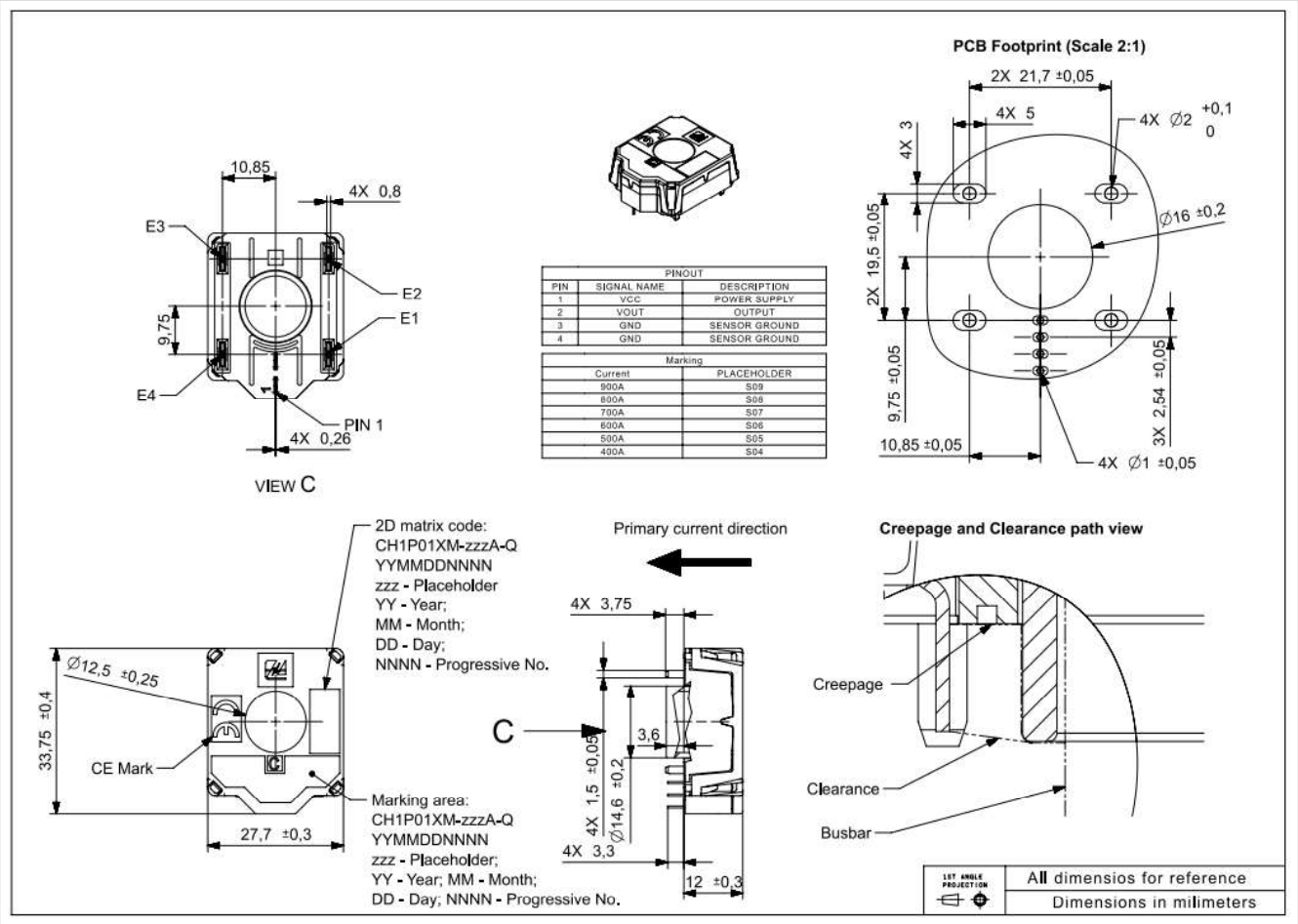
Current Sensor Dimensions (in mm)

CH1P014M – Full Sleeve



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Absolute Maximum Ratings (non-operating)

Parameter	Symbol	Min.	Typ.	Max.	Units	Comments
Supply Voltage	V_{max}	-0.1		6	V	
Output Current	I_{out}			10	mA	
Storage Temperature	T_{ST}	-40		+125	°C	
Insulation Resistance	R_{INS}	500			MΩ	500V DC, 60s
Current leakage due to dielectric voltage	I_{LEAK}			1	mA	2.5kV AC, 50Hz, 1min
Comparative tracking index	CTI	PLC0 (600V)				UL746A (IEC 60112)

Creepage / Clearance (per part version)

Part Name	Parameter	Symbol	Min.	Typ.	Max.	Units	Comments
CH1P012M No sleeve	Creepage	D_{CREE}		3.06		mm	PIN 4 to sleeve inner wall
	Clearance	D_{CLEA}		3.06		mm	PIN 4 to sleeve inner wall
CH1P013M Partial sleeve	Creepage	D_{CREE}		6.67		mm	PIN 4 to sleeve inner wall
	Clearance	D_{CLEA}		3.06		mm	PIN 4 to sleeve inner wall
CH1P014M Full sleeve	Creepage	D_{CREE}		6.67		mm	PIN 4 to sleeve inner wall
	Clearance	D_{CLEA}		3.06		mm	PIN 4 to sleeve inner wall

Creepage and Clearance given as worst case. Note: Nearest signal pin is PIN 2 (VOUT).

Mechanical Product Properties

Parameter	Symbol	Level	Standard	Comments
Flammability Class		V0	UL94	

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Common Characteristics in Normal Range

Parameter	Symbol	Min.	Typ.	Max.	Units	Comments
Supply Voltage	V_c	4.75	5	5.25	V	
Current Consumption	I_c		13	15	mA	
Operating Ambient Temperature	T_A	-40		+125[1]	°C	
Output Offset Voltage	V_o		2.5		V	I_P = 0A
Clamping Voltage Lower	V_{CL}		0.3		V	
Clamping Voltage Upper	V_{CU}		4.7		V	
Supply Capacitance	C_{SUP}	47	100		nF	supply capacitor needs to be located near supply pins
Load Capacitance	C_L		2.2	5	nF	higher capacitance has influence to bandwidth
Load Resistance	R_L	10	25	200	kΩ	R_L for pull-down or pull-up
Power-on Time	t_{po}			1	ms	
Response Time	t_r			6	us	
Frequency Bandwidth	BW	40			kHz	@-3dB
Phase Shift	$\Delta\varphi$	-4		0	°	@DC to 1kHz

[1] Busbar surface temperature shall not exceed 150 °C.
Primary current frequencies can cause heating of the busbar and magnetic core.

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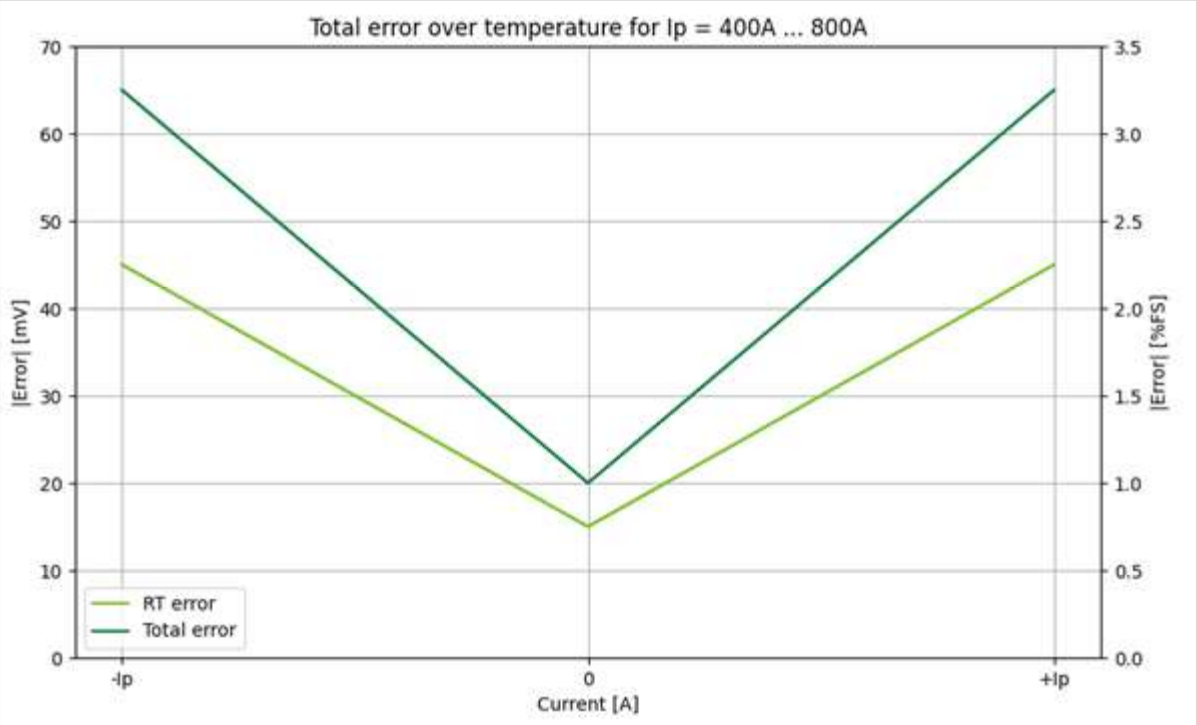
Primary Current Range and Sensitivity

Part Name	Primary Current (Ip)	Sensitivity (Sth)
CH1P01xM-S04A-Q	±400 A	5.00 mV/A
CH1P01xM-S05A-Q	±500 A	4.00 mV/A
CH1P01xM-S06A-Q	±600 A	3.33 mV/A
CH1P01xM-S07A-Q	±700 A	2.86 mV/A
CH1P01xM-S08A-Q	±800 A	2.50 mV/A
CH1P01xM-S09A-Q	±900 A	2.22 mV/A

Total Error Over Temperature (±400A to ±800A)



Primary Current $\pm I_P$	Total Error @25°C		Total Error @Trange	
(A)	(mV)	(%)	(mV)	(%)
+IP	±45	2.25%	±65	3.25%
0	±15	0.75%	±20	1.00%
-Ip	±45	2.25%	±65	3.25%

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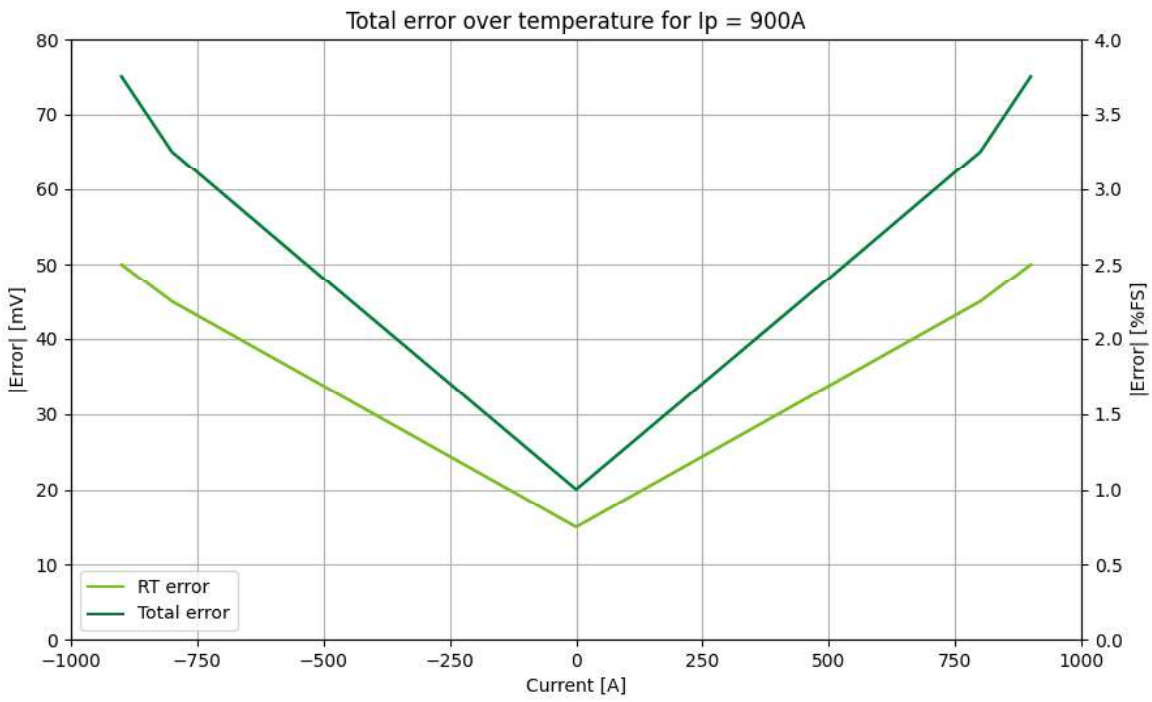
Total Error Over Temperature (±900A)



Primary Current $\pm I_P$	Total Error @25°C		Total Error @Trange	
(A)	(mV)	(%)	(mV)	(%)
+900	±50	2.50%	±75	3.75%
+800	±45	2.25%	±65	3.25%
0	±15	0.75%	±20	1.00%
-800	±45	2.25%	±65	3.25%
-900	±50	2.50%	±75	3.75%

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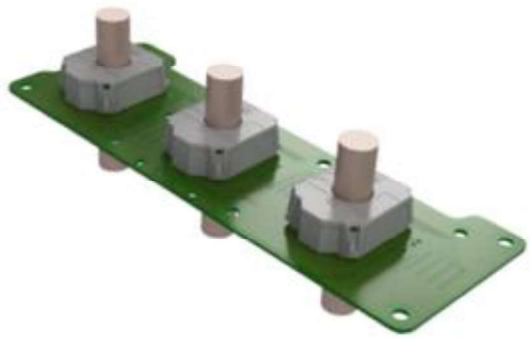
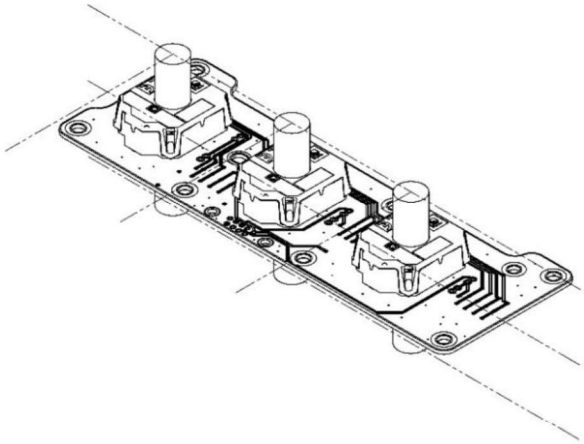
Recommendations for use

PCBA Mounting



- Recommended PCB thickness to be 1.6mm.
- PCB mounting: see soldering recommendation.
- Mounting footprint: see drawing views

Adjacent Cable / Busbar Routing



- Minimum distance between busbars is recommended to be more than 55mm @ 900A.
- Recommended to have busbars straight and parallel through sensor aperture (+/- 30mm).
- No busbar should pass directly above or below current sensor.
- Busbar (or wiring) layout is recommended to be reviewed with Littelfuse.

Soldering Recommendations

Soldering to be performed according to IPC J-STD-001 standard.
To comply with IPC A-610, the following soldering methods are recommended.

Manual – Soldering Iron

- Electrical pin connection (Pin 1 … 4): 40W/380°C iron temperature, tip: 0.8mm tapered.
- Mass pins (E1 to E4): 200W/370°C iron temperature, tip: 7mm flat.

Selective soldering

- Use of gaussian solder nozzles is recommended.

Robotic Soldering Iron

- Possible process parameter evaluated with equipment supplier.

Wave soldering for THD type

- Possible process parameter evaluated with equipment supplier.

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Validation Test Specification

Reference	Test condition
Environmental	
Thermal cycles	IEC60068-2-14 test Nb (2009) 1000 cycles, -40°C / 125°C / 10°C/min
Thermal shock	IEC60068-2-14 test Na (2009) 1000h, -40°C / 125°C
High humidity	IEC60068-2-78 (2001) 1000h, 85°C/85%HR
High temperature storage	IEC60068-2-2 (2007) 1000h, 125°C
Low temperature storage	IEC60068-2-1 (2007) 1000h, -50°C
Mechanical	
Mechanical Shock	IEC 60068-2-27 test Ea (2008) 500m/s^2, 10 x 3 axis
Random Vibration	IEC 60068-2-64 test Fh (2008) 10-2khz; ~9.7G
Electrical	
Output noise test	Littelfuse validation test procedure
di/dt test	Littelfuse validation test procedure 100A/µs, current peak 700A
dv/dt test	Littelfuse validation test procedure 2kV/µs to 2kV
Insulation resistance test	ISO16750-2 (2012) – Insulation resistance 500V DC/1 min
Withstand voltage	ISO16750-2 (2012) – Withstand voltage Dielectric voltage (2.5kV AC, 50Hz, 1min)
EMC-ESD	
EMC01 - Radiated Emissions (ALSE)	IEC CISPR25
EMC02 - Radiated Immunity: Bulk current injection (BCI)	GWM3097 3.4.1 (2015) ISO 11452-1 & -4
EMC03 - Radiated Immunity: Anechoic chamber	GWM3097 3.4.2 (2015) ISO 11452-1 & -2
ESD Handling Test	GMW3097 3.6.3 (2019) ISO 10605 (2001)
Other	
Whisker testing	JESD22A121/JESD201A
Phase shift test	Littelfuse validation test procedure

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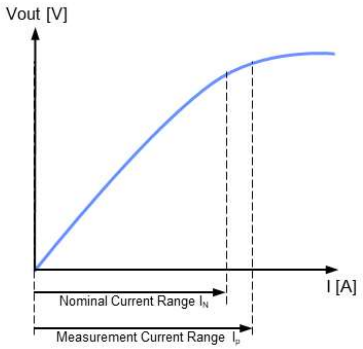
Performance Parameter Definitions

Output Voltage (V_{OUT})

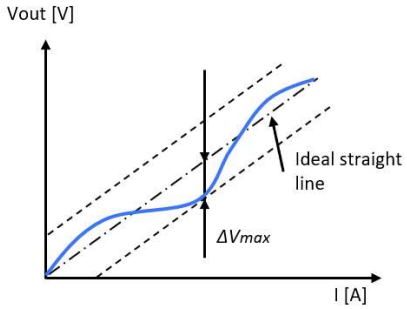
$$V_{out} = (V_{CC}/5) \times (2.5 + I_p \times S)$$

Primary current definition (I_N, I_p)



Linearity error (ε_L)

The maximum positive or negative discrepancy with a reference straight line $V_{out} = f(I_p)$.



$$\varepsilon_L = \pm \frac{\Delta V_{max}}{V_{FS}} \times 100\%$$

V_{FS}: full scope output voltage

Offset error (ε_O)

The voltage drift of the measured sensor output V_{out} at 0A compared to the ideal value 2.5V (@V_c = 5V) is called the total offset voltage error. This offset error can be attributed to the electrical offset, magnetic offset and related drift over temperature.

$$\varepsilon_O = \pm \frac{V_{out} - V_O}{V_{FS}} \times 100\%$$

Sensitivity error (ε_S)

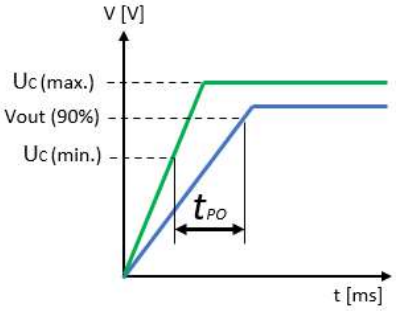
The sensor sensitivity error is the drift of sensor's ideal sensitivity.

$$\varepsilon_S = \pm \frac{S - S_{th}}{S_{th}} \times 100\%$$

S_{th}: theory sensitivity

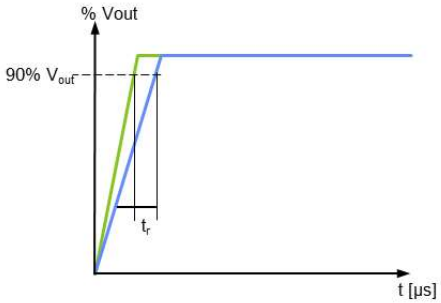
Power-on time (t_{po})

The Power-on time is the duration from Uc (min.) to 90% of Vout.



Response time (t_r)

The time between the primary current signal and the output signal reaching at 90% of its final value.



Typical, minimum and maximum values

Typical, minimum, and maximum values are determined during initial product characterization.
Typical values representing the normal of statistical ±1σ interval (68.27% probability).Minimum and maximum values representing the Gaussian distribution boundaries of the ±3σ interval (99.73% probability).

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Contact

Custom electrical and environmental specifications can be designed to meet any need, please contact Littelfuse Engineering for details.

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